APPENDIX G

FIELD VERIFICATION REPORT
HANFORD SITE
MAY 2-11, 1994

CONTENTS

ATTACHMENTS

EXECUTIVE SUMMARY

This report presents the results of a review of chemical safety vulnerabilities associated with facilities owned or operated by the Department of Energy (DOE) at the Hanford Site. The field verification review took place from May 2 to May 11, 1994, and was part of the Chemical Safety Vulnerability Review being conducted by the Office of Environment, Safety and Health at the direction of the Secretary of Energy. The purpose of the review is to identify and characterize conditions or circumstances involving potentially hazardous chemicals at DOE sites and facilities. Specifically, the review is designed to identify, characterize, and prioritize chemical safety vulnerabilities associated with conditions or circumstances that might result in (1) fires or explosions from uncontrolled chemical reactions, (2) exposure of workers or the public to chemicals, or (3) releases of chemicals to the environment.

Activities involving the use of hazardous chemicals at Hanford include production-related processes and operations; cleanup of facilities being shut down; laboratory processes; long-term, large-scale storage; and the treatment and disposal of hazardous wastes. The lines of inquiry developed for the Chemical Safety Vulnerability Review were used as a guide for field verification activities at Hanford. All facilities included in the Hanford self-evaluations were reviewed, and additional facilities were reviewed when further information was needed. Tank farm operations and facilities were excluded from this review because of the numerous documented appraisals and ongoing reviews being conducted by DOE and other external groups.

The Hanford field verification was conducted with a view toward identifying possible DOE-wide chemical safety vulnerabilities. Three chemical safety vulnerabilities were identified at Hanford, none of which represent a potential consequence of high severity in the near term:

- Large quantities of surplus hazardous chemicals are being stored for prolonged periods in production facilities that are being transitioned to deactivated status;
- Weaknesses exist in some aspects of the hazard analysis program at Hanford; and
- A loss of corporate knowledge may adversely affect cleanup activities at the Hanford Site.

Two chemical safety vulnerabilities identified at Hanford are associated with (1) the prolonged storage of hazardous chemicals in shutdown or deactivated facilities and (2) the loss of corporate knowledge that will be critical when equipment and systems are operated, breached, or disassembled during cleanup activities. In both cases, the field verification team noted that the process of transitioning facilities from an operational status to deactivation, surveillance and, maintenance, and decontamination and decommissioning requires a significant period of time. This prolonged process is partly a result of the DOE decision-making process, the involvement of stakeholders, and multiple requirements by regulatory organizations. The other chemical safety vulnerability reflects weaknesses in job hazards analyses, chemical safety training, hazards analysis for nonnuclear, low-hazard facilities, and differing work control systems used by the multiple contractors at the Hanford Site.

These vulnerabilities, along with those identified at other DOE sites, will be evaluated to identify DOE-wide generic vulnerabilities. Information from the Office of Environmental Management's Surplus Facilities Inventory Assessment and the extended review of potential organic-nitrate vulnerabilities (similar to those at Tomsk-7) will also be considered. The results of these activities will be reviewed for additional insights into potential chemical safety vulnerabilities.

Vulnerabilities identified at Hanford will be used to develop a site-specific management response plan, which in turn will provide input for the DOE-wide management response plan.

The field verification team identified six commendable practices during its review of Hanford facilities:

- The Pacific Northwest Laboratory's (PNL) computer-based Chemical Management System (CMS), which inventories chemicals by using bar-codes to facilitate tracking and inventory checks;

- The Hanford Occupational Exposure Assessment Program (HOEAP), which was developed to provide a uniform sitewide occupational exposure assessment system by grouping similar activities and documenting qualitative assessments in a common data base;

- A cooperative program between DOE, PNL, and Westinghouse Hanford Company in the 300 Area, which resulted in a tenfold reduction in the discharge of wastewater since 1988 and has greatly improved wastewater quality;

- A unique Hazardous Materials Management and Emergency Response (HAMMER) program, which will provide hands-on, performance-based training in all aspects of hazardous materials safety;

- A PNL system to notify the PNL Emergency Coordinator when chemical inventories reach 90 percent of the facility permissible threshold quantity, so that potential impacts to emergency plans can be monitored; and

- A post-traumatic shock-treatment program at the Hanford Environmental Health Foundation, which cares for the emotional and psychological needs of accident victims, their co-workers, and family members,

1.0 INTRODUCTION

1.1 Purpose and Scope

Based on direction from the Secretary of Energy, the Assistant Secretary for Environment, Safety and Health established the Chemical Safety Vulnerability Working Group to review and identify chemical safety vulnerabilities at facilities owned or operated by the Department of Energy (DOE). The information obtained from the review will provide the Working Group with valuable input for identifying generic chemical safety vulnerabilities that confront the DOE complex. Identifying and prioritizing generic chemical safety vulnerabilities will provide an appropriate basis for the Department's focus on programs, funding, and policy decisions related to chemical safety. The Secretary directed the Office of Environment, Safety and Health (EH) to lead this effort, with the full participation of DOE line programs having operational responsibilities.

The Chemical Safety Vulnerability Review was designed and undertaken to identify and characterize adverse conditions and circumstances involving potentially hazardous chemicals at facilities owned or operated by the Department. Specifically, the review was designed to identify, characterize, and prioritize chemical safety vulnerabilities associated with conditions or circumstances that might result in (1) fires or explosions from uncontrolled chemical reactions, (2) exposure of workers or the public to hazardous chemicals, or (3) release of hazardous chemicals to the environment. Using input provided by line organizations with operational responsibilities, the Working Group developed a project plan[1] to guide the review.

The field self-evaluation phase of the Chemical Safety Vulnerability Review used a standardized question set developed and distributed by the Working Group to collect data related to chemical safety from 84 facilities located at 29 sites. Based on review of this input, nine sites, including the Hanford Site, were selected to participate in the field verification phase of the review. The field verification process was designed to use independent teams of technical professionals with experience in a variety of technical disciplines to confirm the accuracy and completeness of the data compiled during the field self-evaluation phase of the review. This report documents activities related to the field verification phase of the Chemical Safety Vulnerability Review.

The field verification team visiting Hanford examined a broad range of facilities (based on facility type and operational status), with special attention given to those facilities being transferred to, awaiting, or undergoing decontamination and decommissioning (D&D). Different types of chemical- and waste-handling facilities—including laboratories, process facilities, and waste treatment and storage facilities—were examined. (See Section 1,3 for a listing of the key facilities visited.)

The field verification team, under the direction of a DOE team leader, was composed of DOE and contractor personnel with technical expertise in various aspects of chemical safety, including management and operations, training, chemical process safety, industrial hygiene,

[1] "Project Plan for the Chemical Safety Vulnerability Review," dated March 14, 1994.

maintenance, environmental protection, and emergency preparedness. A team composition list is provided in Attachment 1 of this appendix.

The team began its review at Hanford by visiting each of the facilities selected for self-evaluation. The team met with management or technical representatives from each of the facilities reviewed. Individual and small group meetings were also held, and team members conducted facility walkthroughs, document reviews, and personnel interviews to gather information related to potential chemical safety vulnerabilities at Hanford. The team leader met periodically with local DOE and contractor management to discuss the team's activities and to review issues that may have surfaced during the previous day. Before the field verification team left the Hanford Site, DOE and contractor management conducted an onsite factual accuracy review of the draft document. An outbriefing was conducted on Wednesday, May 11, 1994, and a copy of the draft report was provided to the Richland Operations Office (RL).

1.2 **Site Description**

The Hanford Site comprises 560 square miles of semiarid desert in southeastern Washington State (see Figure 1). The Columbia River flows through the northern part of the site and turns south to form part of its eastern boundary. The Yakima River forms part of the site's southwestern boundary. The areas adjoining Hanford to the west, north, and east are predominantly agricultural, including vineyards, orchards, and rangelands. The Tri-Cities of Rich land, Kennewick, and Pasco, with a combined population of about 150,000, are located southeast of the site. Hanford is currently operated by four major contractors: Westinghouse Hanford Company (WHC); Battelle Memorial Institute's Pacific Northwest Laboratory (PNL); ICF Kaiser Hanford Company (ICF KH), a subcontractor to WHC; and Hanford Environmental Health Foundation (HEH F). Bechtel Hanford Incorporated will assume the remediation contract later this year.

The Hanford Site is divided into several areas, each of which is devoted to specific types of facilities and activities. Nine older plutonium production reactors are located in the 100 Areas, which are situated along the Columbia River in the northern part of the site. All nine reactors have been retired, and eight are in an advanced stage of decontamination and decommissioning. Chemical processing and waste management facilities (including the PUREX Plant, the Plutonium Finishing Plant, and the tank farms) are concentrated in the 200 Areas, East and West. The 300 Area, located in the southeast corner of the site, contains a complex of laboratories, technical shops, engineering offices, and support facilities that focus on research and development associated with waste management and energy technologies. The 400 Area is located north of the 300 Area and includes a retired sodium-cooled fast flux test reactor.

The Hanford Site includes facilities constructed during World War II as well as recently built modern structures. Defense production has been the primary mission throughout most of the site's history. Today, however, Hanford's activities focus on environmental restoration and waste management; scientific and environmental research; development and application of radioactive and hazardous waste management technologies; and the design, construction, and operation of major energy-related test and development facilities.

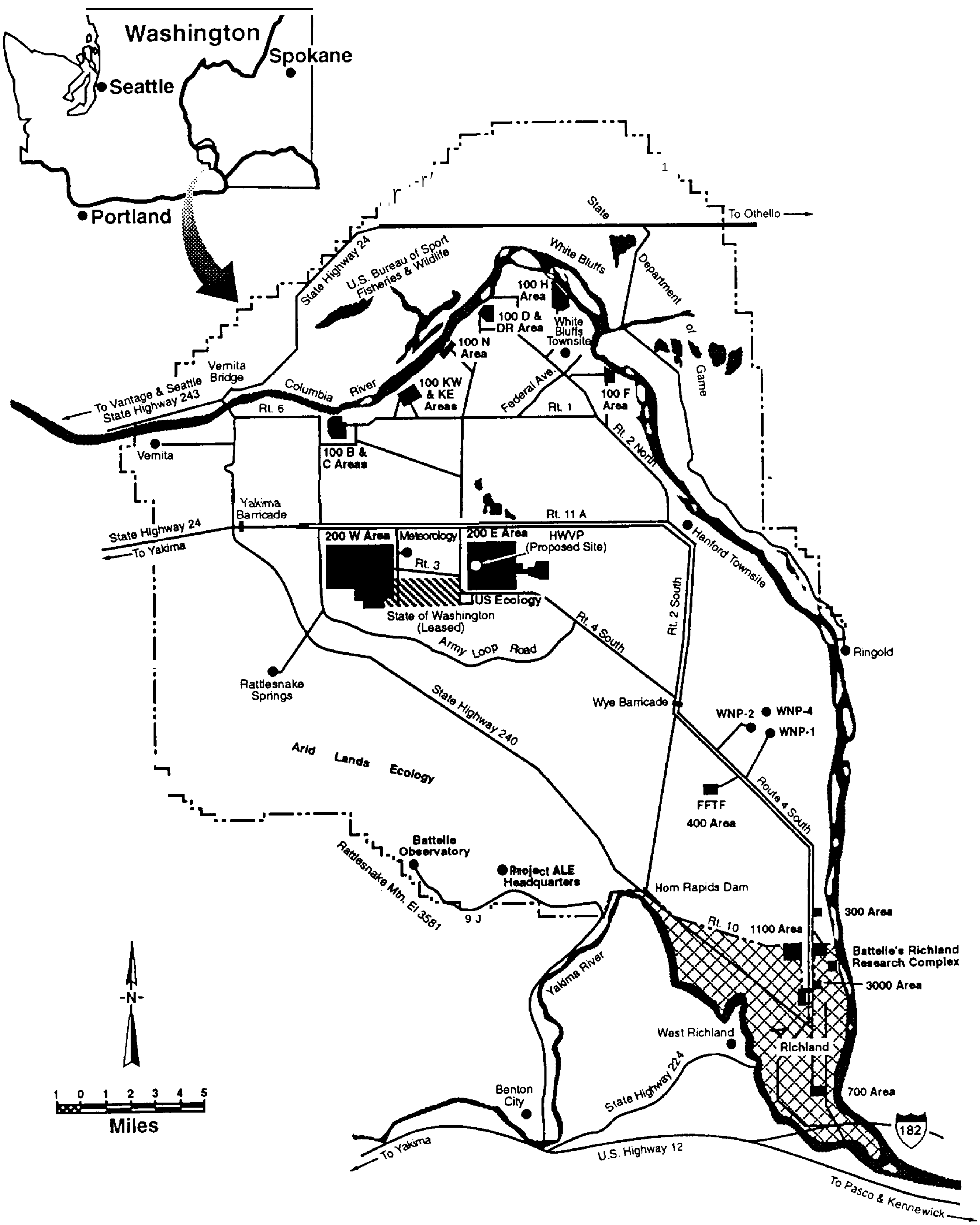

Figure 1. Hanford Site.

1.3 Facilities Visited

Tables 1 and 2 identify key facilities visited by members of the field verification team at the Hanford Site and include information related to the physical condition and mission of each facility.

Table 1. Key WHC Facilities Visited at Hanford.

FACILITY	MISSION	DESCRIPTION
Chemical Engineering Laboratory, 2703E Building*	Nonradioactive chemical engineering pilot plant, process demonstration and evaluation of chemical-proceesing equipment	Completed in 1963, the Chemical Engineering Laboratory is a steel-frame structure with dimensions of about 48 x 60 x 44 feet. The building includes two modular mezzanines. Adjacent to the building are (1) two pre-engineered storage buildings designed for hazardous chemical and waste storage and (2) several prefabricated storage units, one of which is currently used for storage of dry chemicals.
Water Treatment Plant, 283E Building	Potable water for 200 East Area	Constructed in the 1940s, the water treatment facility has been modified and upgraded several times. The facility has a capacity of 2,600 gallons per minute. The chlorination system building has one cylinder in service and room to store three additional cylinders The chlorination feed system was upgraded in 1993.
Plutonium Finishing Plant, 234-5Z Building*	Process facility, laboratory, and storage facility for special nuclear material	Built in 1849, the Plutonium Finishing Plant is a steel-frame structure overlaid by noncombustible materials. The plant's dimensions are about 180 x 500 feet, The vault and process area doors of the facility are constructed of steel and have combination safe-type locks. The larger process portions of the facility are currently inactive. Small glovebox portions of the facility, the laboratories, and the storage vaults are still operational.
PUREX Plant, 202A Building*	Process facility	Built in 1952, the PUREX Plant is a reinforced-concrete structure with dimensions of about 1,005 x 119 x 100 feet. The building has three main structural components: (1) a thick-walled concrete canyon in which equipment for radioactive processing is housed; (2) the Pipe and Operating, Sample, and Storage galleries; and (3) a steel and transite annex that houses offices, process control room, laboratories, and building services. Adjacent to the main building are a tank yard for chemical storage and a number of support buildings, one of which is used for chemical storage. The PUREX Plant is currently undergoing deactivation.
RCRA Hazardous Waste Storage Facility, 616 Building	Permitted for storage of nonradioactive hazardous waste	Completed in 1966, this two-story, reinforced-concreta building was designed specifically for storage of hazardous waste defined under the Resource Conservation and Recovery Act (RCRA), The facility contains an office area, a staging area for receiving and dispensing containers, a sampling/analysis area, and four container storage bays separated by concrete walls. One bay is used for flammable liquids with flashpoints of less than 70 OF and has blowout roof and wall panels.

Facilities marked with an asterisk (*) were included in the field self-evaluation process.

Table 2. Key PNL Facilities Visited at Hanford.

FACILITY	MISSION	DESCRIPTION
High Bay Engineering Laboratory, 324 Building*	pilot-scale and full-scale demonstration activities, development of waste solidification equipment	The High Bay Engineering Laboratory has dimensions of 43 x 48 x 65 feet and is part of a larger structure (324 Building) that has been designated as a Category 2 nuclear facility. The 324 Building contains several large hot cells for working with highly radioactive materials, but the High Bay itself is not used for work involving radioactive materials.
Warehouse, 37 I 8G Building*	Storage of nonradioactive chemicals for 324 Building	37 I 8G Building is a single-story, steel-frame building with about 3,5oO square feat of floor apace. The front of the building contains a staging area, cabinets and shelves for storing supplies, and small quantities of solid chemicals. The rear section is cubed and used for the bulk storage of liquids.
Life sciences Laboratory 1, 331 Building*	Research and development in biology and the environmental sciences	Completed in 1971, the Life Sciences Laboratory is a 127,000-square-foot, three-story building constructed of reinforced concrete. The ground floor and third floor contain administrative offices, maintenance ahops, a variety of laboratories, and animal and surgical facilities. The second floor houses the heating, ventilation, and air-conditioning system and service areas and has a mezzanine overlooking the main Iobbv and Iibrary.
RCRA Hazardous Waste Storage Facility, 305B Building	Permitted for storage and packaging of RCRA hazardous and mixed waste	The facility consists of a two-story, high-bay, concrete building constructed in the early 1950s. The basement contains two vaults that originally housed small test reactors. One vault has been converted for storing mixed waste. The ground floor contains administrative offices and a high bay that was originally used for pilot testing. The high-bay area was modified and upgraded several years ago for storage of nonradioactive hazardous wastes.

Facilities mailed with an asterisk (*) were included in the self-evaluation process.

2.0 SUMMARY OF RESULTS

The field verification process was designed to use independent teams of safety professionals to verify the accuracy and completeness of data provided to the Chemical Safety Vulnerability Review by Hanford facilities selected to participate in the field self-evaluation process. The verification process offers an opportunity to scrutinize site-specific chemical safety vulnerabilities and to make informed judgments about the possible relevance of these conditions to determinations of generic chemical safety vulnerabilities.

The goal of the field verification team was to identify chemical safety vulnerabilities at Hanford. Before arriving on site, team members reviewed the self-evaluation data and other documents to develop lists of potential vulnerabilities for their functional areas. During the onsite portion of the review, team members visited facilities selected for self-evaluation to verify reported observations and to look for other conditions or circumstances that might result in chemical safety vulnerabilities. Water treatment facilities using chlorine that were not included in the original self-evaluation were also reviewed. Team members who visited these facilities coordinated with their site counterparts to arrange for the appropriate walkthroughs or interviews.

To support effective team management and to expedite the identification of vulnerabilities across a wide range of technical disciplines associated with chemical safety, the field verification review was organized to include five functional areas:

- <u>Identification of chemical holdings</u>, including the properties of chemicals located at the facility, the characterization of those chemicals, and an analysis of the inventory.

- <u>Facility physical condition</u>, including engineered barriers, maintenance conditions, chemical systems, safety systems, storage, monitoring systems, and hazards identification.

- <u>Operational control and management systems</u>, including organizational structure; requirements identification; hazard analysis; procedural adherence; maintenance control; engineering and design reviews; configuration control; safe shutdown plans; and site programs for quality assurance, chemical safety, inventory control, access control, disposal, transportation and packaging, and corrective actions.

- <u>Human resource programs</u>, including technical competence, staffing, training and qualifications, employee involvement, employee concerns, personnel performance requirements, and visitor and subcontractor access control.

- <u>Emergency management program</u>, including the emergency response plan, in-plant consequences, environmental issues, coordination with the community, and community right-to-know issues.

These functional areas were evaluated based on lines of inquiry provided in Attachment 1 of the “Field Verification Guide for the Chemical Safety Vulnerability Review,” dated

April 8, 1994. A summary of results for each of the functional areas is provided below. Completed chemical safety vulnerability forms resulting from the field verification activities at Hanford are provided in Attachment 2 of this appendix.

2.1 Identification of Chemical Holdings

Verification activities associated with the chemical holdings functional area indicate that chemical inventories in facilities reviewed at Hanford are below 25 percent of the threshold quantities listed in 29 CFR 1910.119 or 40 CFR 68. The one exception is nitric acid, which was used as a process chemical in the Plutonium Finishing Plant (PFP) and the PUREX Plant. Nitric acid in storage at these plants totals approximately 1,000 tons. Other process chemicals stored at PFP and PUREX in ton quantities include aluminum nitrate solutions, sodium hydroxide, sodium nitrate, sodium nitrite, carbon tetrachloride, and tributylphosphate dissolved in normal paraffin hydrocarbon (NPH). These chemicals are stored outside in stainless-steel tanks, and there is some concern about the potential corrosion of older tanks. The long-term, outdoor storage of carbon tetrachloride in drums at PFP is unsatisfactory.

These conditions are described in Vulnerability CSVR-RL-HAN-O1, which concludes that the prolonged storage of hazardous chemicals in shutdown or deactivated facilities may lead to unanticipated hazards caused by leakage, spills, evaporation, decomposition of chemicals, or lack of adequate administrative controls. Since 1991, however, there has been significant progress in reducing bulk storage of hazardous chemicals. More than 2,000,000 pounds of hazardous chemicals have been removed from the site, including nitric acid, sulfuric acid, NPH, potassium hydroxide, and hydrogen peroxide from PUREX, as well as hydroxylamine nitrate and calcium metal from PFP.

While the field verification visit was in progress, EH requested that the verification team include chlorination facilities in the review scope. The site provided a list of eight water supply facilities with chlorine inventories exceeding the threshold quantities stipulated in 29 CFR 191O.119. (Treated sanitary waste is discharged to septic drain fields or to evaporation beds without chlorination.) Facilities 163-N, 183-KE, 182-B, 182-D, 283-W, 283-E, and 315 were each reported to have inventories of chlorine ranging between 2,000 and 4,000 pounds. Facility 183-D includes storage of chlorine cylinders with a total reported inventory of 24,000 pounds. Chlorine at these facilities is supplied from 1-ton cylinders and is added to water by means of the same process used in many municipal water supply and wastewater treatment plants. The remote placement of many Hanford units minimizes risk to the public. Releases from some of these facilities, however, could threaten occupants of site buildings. Facility 315 is located about ¾ mile from the nearest private residences, but it is within about 200 feet of PNL buildings housing several hundred people. (Facility 315 was the subject of an analysis in 1993, summarized in DOE/E H-0340, Example *of Process Hazard Analysis of a Department of Energy Water Chlorination Process,* dated September 1993.) The chlorination system at facility 283-E was examined by the team. This system was upgraded in 1993 and is the same as that used at facility 283-W. The designs for chlorine feed and cylinder storage and the procedures used for inspections, maintenance, and cylinder changeout were found to be satisfactory for minimizing hazards arising from chlorine leaks, but the need to provide locked access to chlorine facilities needs to be reviewed. Although no indicators were found of a risk higher than those at well-designed and well-maintained municipal facilities, alternatives to gaseous chlorination, such as sodium hypochlorite solution or ultraviolet treatment, should be considered for increasing worker and public safety.

The three laboratory facilities reviewed by the verification team contained a wide variety of chemicals, including nonhazardous chemicals such as glucose and glycerol, hazardous chemicals such as inorganic and organic acids, and hazardous and mixed wastes in temporary storage at satellite accumulation areas. The two engineering laboratories (Chemical Engineering Laboratory [CEL] and High Bay Engineering Laboratory [HBEL]) use relatively large quantities of hazardous chemicals (e.g., nitric acid, sodium nitrite, formic acid, and sodium hydroxide) to prepare simulated high-level wastes for testing treatment techniques. At HBEL, these chemicals are stored in an external warehouse, and about every 6 months, they are moved into the laboratory to support process operations that typically last for several weeks. At CEL, chemicals are withdrawn from storage as needed. The contents of chemical warehouses for both laboratories were less than the threshold quantities stipulated in 29 CFR 1910.119 and 40 CFR 68. Storage, labeling, and containment of chemicals were found to be satisfactory-although 3718G Building, the principal chemical warehouse for HBEL, does not have a fire suppression system (it does have smoke detectors, alarms, and pull stations). This condition is recognized by PNL, and plans are in place for a new warehouse estimated to be completed in FY 95.

Both WHC and PNL have developed and implemented computer-based chemical inventory systems. The WHC system, Hazardous Materials Inventory Database (H MID), was implemented primarily to comply with Title Ill of the Superfund Amendments and Reauthorization Act of 1986 (SARA) and other reporting requirements. Input is provided by all facilities maintain local data bases and upload data into HMID on a monthly basis; thus, the system is not “real time.” The system contains valuable information that could be used by management for tracking and controlling hazardous materials on site, but that application has received limited use.

PNL uses a computer-based inventory system, the Chemical Management System (CMS), to inventory chemicals, provide data for SARA Title III reporting, provide hazard information, and minimize chemical waste. CMS includes a linkage to the purchasing system so that new chemicals are automatically recorded in the data base. New chemical containers are bar-coded on receipt, and all existing chemical containers in PNL facilities have bar-codes, thereby facilitating tracking and inventory checks. CMS has been in use since November 1991 and is fully implemented at PNL facilities. The field verification team at Hanford recommends CMS as a commendable practice.

Chemical residues are of concern primarily in PFP and PUREX, where small quantities of nitric acid have been left in glovebox lines and equipment or in canyon lines and vessels. Most of these solutions contain special nuclear material and radioactive residues that will be neutralized and flushed to waste tanks as part of the continuing cleanout and deactivation process.

Hazardous waste inventories for the facilities reviewed by the field verification team are managed in accordance with the programs established respectively by PNL and WHC to meet the requirements of regulations promulgated by the State of Washington under delegated authority from the U.S. Environmental Protection Agency. Each program establishes a basic infrastructure of plans, procedures, guidance, and oversight with concomitant organizations and responsibilities. The centralized, permitted Resource Conservation and Recovery Act (RCRA) Waste Storage Facilities located in 305B Building (for PNL) and 616 Building (for WHC) are managed by their respective central waste management groups. Both are well designed and operated, and both are exemplary in almost every respect. Although there are fundamental differences in the degree of centralized control with which satellite accumulation and 90-day storage areas are administered (e.g., location and usage), each program relegates management of these areas to the organization that generates the waste (i.e., the "generator"). Guidance is provided through training, procedures, technical support, and coordination of self-assessments.

Characterizations of accumulated hazardous wastes are largely the responsibility of the generator. Specific waste acceptance criteria have been developed, not only for waste characterization but also for packaging and labeling. Since there is generally a high degree of process knowledge related to waste generation, only a small percentage of hazardous waste containers is currently analyzed. Most wastes requiring analysis are mixed wastes. Negotiations between waste management groups and the State of Washington, however, will likely result in requirements for a random sampling and analysis program that may increase sampling and analysis to between 5 and 10 percent of the containers.

An area needing enhancement involves generator implementation of procedures and localized controls. Performance in this area is generally good, but inconsistencies were reported for labeling, co-storage of incompatibles, and maintenance of area logs. These are not considered to represent significant chemical safety vulnerabilities, but they indicate of a need to upgrade overall performance-not only to ensure compliance but to enhance attitudes in a manner consistent with responsible hazardous materials management.

Water discharges from all evaluated facilities are well controlled and reflect the sitewide program undertaken in 1989 to improve water and wastewater management. In most buildings, blind sumps are now used or sump drains are locked and are subject to administrative controls before use. In large part, these controls are based on the 1988 Federal Facilities Agreement and Consent Order (or Tri-Party Agreement), which required a comprehensive program to reduce uncontrolled releases. In the past, most water drains and sumps were discharged to "cribs" or process trenches, with few controls and no wastewater treatment. The verification team observed an increased sitewide awareness of the need to exercise conservation in water use in general, as well as to control wastewater discharges. The comprehensive water management program currently being undertaken includes installation of wastewater treatment systems both at specific facilities and for area-wide treatment, retirement of drains and sumps, implementation of engineered and administrative controls for operating sumps and drains, and upgrade of associated drainage and transfer piping. In the 300 Area alone, cooperation between RL, PNL, and WHC has reduced wastewater discharges from 1,500 gallons per minute (gpm) in 1988 to fewer than 150 gpm today and has greatly improved wastewater quality. In 1993, this program earned the energy efficiency award for water conservation at Federal facilities. These are commendable efforts and reflect a successful hierarchical approach to wastewater minimization that began with source reduction and progressed through waste segregation to waste treatment and disposition.

Exhaust stacks, vents, and fugitive emissions have been well characterized for most facilities reviewed at Hanford, and required controls have been implemented. The principal exception involves laboratories, which generally have been exempt from air emissions regulations. Laboratories alone are unlikely to represent a vulnerability with respect to air emissions; however, a concerted effort has not been made to characterize these sources accurately. Initiatives in this area are currently under way to respond to air toxics regulations and to permitting requirements resulting from amendments to Title V of the Clean Air Act.

2.2 **Facility Physical Condition**

Verification activities associated with the facility physical condition functional area included review of general maintenance conditions at all facilities selected to participate in the field self-evaluation. In addition, the verification team visited the 616 Building, the 305B Building (RCRA storage facilities), and the 283-E water supply facility (which is operated for WHC by ICF KH). The review focused on conduct of maintenance activities, maintenance program controls, work controls, and the structural and mechanical integrity for various systems (e.g., heating, ventilation, and air conditioning).

In general, the condition of these facilities was as described in the self-evaluations, which noted no special problems likely to result in chemical safety vulnerabilities. The self-evaluation for the PUREX Plant, however, indicated that portions of cell walls and floors have been eroded by nitric acid contamination and that some vessels show evidence of corrosion from chemical spills. These conditions could not be verified because access to the affected areas is limited. In addition, subsurface conditions around some sump and drain systems at many of the facilities visited have not been investigated, although these systems have carried waste chemicals in the past and could be deteriorating (e.g., at PFP). However, discharge “cribs” have been evaluated as a part of the Tri-Party Agreement, and contamination is being monitored and/or remediated. Because of their location and magnitude, sumps and drains are not generally considered to be a chemical safety vulnerability. Collectively, these issues could represent a potentially costly addition to future deactivation and D&D activities, and sumps and drains will need to be addressed as part of future transition plans.

Equipment used at PNL facilities in the 300 Area was observed to be in good condition. Heating and ventilation equipment at 331 Building was determined to be in particularly good condition, reflecting the existence of an effective preventive maintenance program. This equipment is important for maintaining adequate temperature control and balanced airflow for a variety of activities and experiments. Corrective maintenance program controls are adequate, and improvements were being developed at the time of this review. For example, a revised work package system will include a job planning checklist to ensure proper inclusion of hazard controls.

The High Bay Engineering Laboratory (HBEL) contains a large amount of test and experimental equipment related to the High-Level Waste Project. This equipment is maintained in a slightly different manner in that preventive maintenance is accomplished only when test and operations activities are scheduled. Other equipment in this facility is included in the existing PNL Preventive Maintenance Program. It was observed that a few eyewash and emergency shower facilities were not well maintained—that is, eyewash fountains were dirty and plastic protectors were not installed. Plans were being developed to increase the test/flush frequency of this equipment. The self-evaluation indicated that the exterior warehouse used for chemical storage was inadequate (e.g., fire suppression systems were not available). Verification team members visiting the warehouse were informed that a new storage facility is planned.

The PUREX Plant is being transitioned to D&D, and equipment is being deactivated as defined by the Deactivation Project Management Plan. Some equipment that will be operated at least one more time (e.g., for storage tank deactivation) has been placed in a deferred maintenance condition. Surveillance is conducted to identify potential maintenance problems, and maintenance is performed on an as-needed basis. (Examples include the storage tanks for nitric acid, sodium hydroxide, and other process chemicals located outside the main facility.) Inventories of these chemicals were specifically identified in the self-evaluation. Deterioration of this equipment could pose a problem for future operations if the deactivation process is delayed. Housekeeping in the 2714A chemical storage warehouse at PUREX was observed to be poor. Small amounts of chemicals were found stored along with old furniture. Storage areas for maintenance materials (e.g., paint, lubricating oil, and adhesives) were observed to be in excellent condition.

Maintenance at the Plutonium Finishing Plant is still being conducted in a routine manner. Several major repairs to ventilation supply and exhaust systems were in progress at the time of the review. Portions of the facility are being transitioned to a D&D status. Deactivation plans will be developed after completion of an Environmental Impact Statement (EIS). The condition of equipment was generally observed to be good, with no obvious deficiencies that are likely to result in chemical safety deficiencies.

Conditions at the Chemical Engineering Laboratory were observed to be satisfactory. The facility is basically sound, except for minor leaks in the roof. Experimental equipment is properly maintained.

The 616 Building, used for nonradioactive hazardous RCRA waste storage, and the 305B Building, used as a hazardous waste storage and repackaging facility, are both reinforced concrete structures. Both facilities are in excellent condition and are regularly inspected. The 616 Building is an excellent example of a well-designed and well-managed RCRA storage facility,

The 283-E water treatment area was observed to be well maintained. The chlorinator unit is well equipped and in excellent condition, A new chlorinator and leak detection instruments were installed less than a year ago, as is the case at a similar facility (283-W) in the 200 West Area. The chlorine feed system and storage area are adequately designed, including features to maintain a negative pressure in the delivery lines and ventilation systems for potentially occupied areas. Both audible and visual alarm systems, which are tested weekly, are provided at the facility. The WHC Fire Department is equipped with kits approved by the Chlorine Institute to clamp and seal leaking cylinders.

2.3 Operational Control and Management Systems

The operational control and management systems functional area was reviewed as part of the field verification visit to the Hanford Site. In addition to the lines of inquiry, this review focused on the process whereby facilities are transitioned from an operational status to D&D.

Each of the self-evaluation reports compiled by WHC and PNL contains a summary of the programs, procedures, and management systems currently in place to control chemical safety vulnerabilities. Chemical safety at WHC and PNL facilities is based on multiple programs already in place. Existing organizations provide the management structure for these multiple programs; however, roles and responsibilities for carrying out these chemical safety programs are not always clear, particularly within the line organizations.

Hanford contractors have implemented comprehensive programs of workplace hazard recognition, chemical exposure monitoring, and control systems involving engineering controls and personal protective equipment. Considerable effort has been devoted to developing systems to evaluate potential workplace exposures. Both PNL and WHC have developed and implemented hazard assessment programs to inventory workplace hazards, to evaluate the effectiveness of control measures, and to verify safety program implementation. PNL's Workplace Exposure Assessment (WEA) is fully implemented, and the WHC'S Comprehensive Baseline Hazard Assessment (CBHA) is under development.

With RL leadership and contractor participation, the Hanford Occupational Exposure Assessment Program (HOEAP) was developed and is being implemented to provide a uniform sitewide assessment system. Although application is not complete, HOEAP represents a commendable practice that groups similar activities and documents qualitative assessments. Results will be captured into a sitewide information management system that is currently under development for further analysis and quantitative exposure monitoring, as appropriate.

Workplace exposure monitoring is conducted by HEHF, as requested by contractor industrial hygiene personnel. HEHF maintains a data base of monitoring results. Real-time monitoring results taken by contractors are not tracked in the HEHF system, although WHC and PNL maintain their own separate record systems. Notification of contractor industrial hygiene personnel about the results of biological monitoring is incomplete. In addition, industrial hygiene data from the various site contractors are not routinely made available to HEHF medical staff.

Weaknesses were observed in the program and systems for performing various hazard analyses at Hanford. (See Vulnerability CSVR-RL-HAN-02.) Because of the heavy workload of industrial hygiene and industrial safety personnel, WHC does not always review job hazard analyses (JHAs) in a thorough and rigorous manner. The field verification team noted that improvements are needed in the graded approach used to differentiate low-hazard work plans and packages from those for high-hazard work. The differing hazard recognition and control systems implemented by multiple contractors at Hanford further contribute to an increased potential for personnel exposure to workplace hazards. This situation was exemplified by a recent near-miss event involving ICF KH and its subcontractor personnel.

The PNL Life Sciences Laboratory I,331 Building, is a large laboratory facility for chemical, biological, and environmental research. Many hazardous chemicals are present in the laboratory, usually in small amounts. The laboratory was designated as a nonnuclear, low-hazard facility. DOE 5481.1 B requires the preparation of safety analyses for all DOE facilities (other than those designated as excluded). Consistent with this order, PNL Manual PNL-MA-44, "Safety Analysis," requires a safety analysis document (i.e., a hazardous materials permit) for all PNL nonnuclear, low-hazard facilities. No hazardous materials permit exists for 331 Building, and there are no plans to prepare one.

The shift away from a position-based approach for qualification and certification toward a task-based training approach makes job hazards analysis more crucial to the training process. The loss of certified operators with extensive process and facility knowledge also forces greater reliance on job hazards analysis to ensure the safety of personnel, the facility, and the public.

RL has recognized the need for a more systematic approach to identify, analyze, control, and communicate hazards and to define more clearly the requirements for when safety, process, and hazard analyses are needed. As a first step, RL has issued a draft standard (RL-STD-01 -94, "Hazard Analysis and Communication") for comment by Hanford contractors. Implementation of this standard is expected to take place in about 6 months.

WHC has a lessons-learned program in place that has the basic elements of a sound system; however, a recent fatality at the Hanford Site demonstrated the need to communicate lessons-learned information more effectively. As part of its monitoring program, the DOE Office of Safety and Quality Assurance (EH-30) is working with WHC to enhance the current program and establish it as a model for the DOE complex.

Configuration management systems are in place at both PUREX and the Plutonium Finishing Plant. Both systems are currently being reviewed to determine how they can be modified to reflect cleanup and stabilization activities leading to either a surveillance and maintenance (S&M) or D&D configuration for these facilities.

The process of transitioning facilities from an operational status to S&M or D&D is lengthy. (At PUREX, this prolonged transition period has already exceeded 5 years.) The protracted period required for transitioning facilities is the result of many factors, including the following: (1) delays in the DOE decision-making process for mission changes, (2) the DOE decision to involve stakeholders in shutdown processes, and (3) multiple requirements by regulatory oversight organizations. These delays produce a complex set of impacts or uncertainties, including (1) loss of personnel to job transfers or retirement due to unchallenging work or the uncertainty created by the designation of an environmental restoration contractor, (2) a reduction in the reliability of process/process support equipment due to lack of use, (3) uncertainty about how "transuranic RCRA" chemical residue samples will be analyzed, and (4) the need for residues to be held in place until an approved stabilization process is implemented.

Numerous management systems and programs are in place at Hanford to control and eliminate chemical safety hazards. However, weaknesses in existing hazard analysis programs and the protracted time period required to transition facilities to a safe S&M mode or D&D status have increased the site's potential for chemical safety vulnerabilities.

2.4 Human Resource Programs

Verification activities associated with the human resources programs functional area at Hanford focused on training and qualifications, technical competence, employee involvement, staffing, employee concerns, and visitor and subcontractor access control. During the course of these activities, one potential chemical safety vulnerability was identified concerning the loss of corporate knowledge related to facilities and processes. (See Vulnerability CSVR-RL-HAN-03.)

Discussions related to human resource programs were conducted with management, training, and operations personnel representing WHC, PNL, and RL, and additional discussions were held with RL and Hanford Training Center personnel. WHC, PNL, and RL policy documents related to chemical safety programs were also reviewed. Procedures and documents were examined to review the strategy used to implement policies.

WHC and PNL promote a high level of worker awareness about issues related to chemical safety. Chemical hazard information is communicated to employees by a variety of means. A modem training facility is maintained in Richland, offering an extensive curriculum of safety and health courses. In addition to formal training, facility-specific briefings are provided for all personnel entering certain facilities. However, members of the field verification team noted that chemical hazards specific to the workplace were not discussed with employees at several WHC facilities. (See Vulnerability CSVR-RL-HAN-02.) WHC is in the process of approving training materials that will provide for discussions of facility-specific chemical hazards in the workplace.

With the exception of problems related to balancing the workload for industrial hygiene and industrial safety engineers (noted in Vulnerability CSVR-RL-HAN-02), staffing levels were found to be sufficient to ensure that personnel do not work excessive hours and that they have time to address chemical issues. A variety of safety and health professionals are available to support operating facilities. In general, sufficient resources are available to oversee routine and nonroutine chemical activities and to provide technical assistance on a timely basis.

Both WHC and PNL have implemented formal programs to address employee concerns. These programs are independent of the line organizations, and the employees consider them to be effective and useful. The PNL program provides status reports and appropriate input to the *Employee ES&H Exchange Monthly,* a newsletter published by the PNL Safety organization. The WHC program encourages employees raising issues to participate in the resolution of those issues. All issues brought to the program are recorded, analyzed, and tracked through resolution, and appropriate information is forwarded to the lessons-learned program. A review of employee concerns received by WHC and PNL during the period January 1993 through May 1994 identified no significant chemical safety issues. These programs are supplemented by the DOE Occupational Safety and Health (OS&H) Protection Program.

The prescription of training for an individual is the responsibility of that individual and of his or her immediate supervisor. Supervisors are responsible for ensuring that each individual receives the training required for his or her organization, facility, or program. Safety training requirements, the emphasis placed on the completion of training, and the accuracy and retention of records vary greatly between organizations at Hanford.

An extensive communication system is required to establish and maintain a cohesive and effective safety training function within the PNL matrix organization. Communications regarding work assignments, job locations, and necessary safety training appear to be effective, and most matrixed personnel are receiving appropriate safety training.

Access control to PNL facilities at Hanford is achieved through key cards or monitored building entry points. In addition to monitored building entry points, WHC uses a data base system, the Westinghouse Radiation Access Monitor, which queries radiological portions of the Training Records Information system through operators posted at facility access points. The next generation system, Access Control Entry System (ACES), which is currently being tested, will perform these queries automatically. Release 2, the next major revision of ACES, will permit automatic query for all training data related to building entry requirements. At the Chemical Engineering Laboratory, a system of controlled keys and locks is used to maintain access control. Responsibility for visitor access control has been transferred from Hanford Security to the manager of each facility. The transfer of highway security from Hanford Patrol to the Benton County Sheriff's Department, the release of sections of site access roads for public use, and the removal of some guard stations have raised the potential for unauthorized or accidental entry by the public into potentially hazardous areas.

RL links employee hazards awareness training and hazard waste operations training to entry requirements for specific facilities. Because entry requirements are established and maintained locally, there is confusion about which requirements apply, where those requirements are published, and the appropriate facility points-of-contact. If approved and implemented, RLID 5480.ACC, "Hanford Facility Access Requirements" (proposed), will establish basic entry requirements for all Hanford facilities and should resolve the problem. Considerable variation in the understanding of and adherence to chemical safety training requirements by RL personnel was noted.

The loss of corporate knowledge at the PUREX Plant and the Plutonium Finishing Plant may result in a chemical safety vulnerability whenever systems or components are operated, breached, or disassembled. This loss of corporate knowledge is a result of personnel turnover, intermittent configuration management throughout the life of the facilities, failure to capture and retain characterization data, and reductions in the scope of the training programs for these facilities.

2.5 Emergency Management Program

The emergency management program for chemical safety at Hanford is continuously evolving. Rooted in the radiological emergency management program, which has been in place for many years, the emergency management program includes three main components: emergency planning, emergency preparedness, and emergency response. The main driver for the emergency management program is the DOE 5500 series of Orders. For chemical emergencies, the DOE Orders are supplemented by regulations specified by the Occupational Safety and Health Administration (OSHA) in **29** CFR 1910.119 and 29 CFR 1910.120.

Hanford has established a series of interrelated emergency management documents that form an integrated set of emergency plans, including the Hanford Site Emergency Plan, a contingency plan, and fire plans for individual buildings. In addition, Hanford contractors have established facility-specific policies, plans, and procedures that are consistent with the overall emergency plan for the Hanford Site. Emergency implementing procedures have been developed describing the responsibilities, cautions, and activities of emergency responders. Plans address interface with Federal, State, Tribal, and local Governments, and memorandums of understanding are in place for assistance from other organizations (e.g., Kadlec Hospital) that may provide emergency response support or treatment for injured individuals. Chemical emergency plans at Hanford are developed for facilities in which hazards analyses indicate such plans are necessary.

HEHF assists Kadlec Hospital in treating chemically exposed accident victims. HEHF has developed a post-traumatic shock-treatment program to care for the emotional and psychological needs of accident victims, their co-workers, and family members. This program is considered a commendable practice.

Training for chemical emergencies is also an integrated program involving RL and all major contractor organizations at the site. All Hanford personnel (i.e., about 18,000 people) are provided with basic chemical awareness training consistent with DOE Orders and Federal regulations. Each facility is assigned a building manager or lead facility manager who is responsible for ensuring that all personnel at the facility are trained on their responsibilities during an emergency. Specialized training provided for emergency response teams ranges from the command and control duties at the Hanford Emergency Control Centers to detailed, hands-on emergency responder training for hazardous materials (HAZMAT) teams. HAZMAT training conforms to the standards of the National Fire Protection Association, and periodic drills and exercises are conducted to evaluate and maintain a state of readiness to respond to chemical accidents.

A new Hazardous Material Management and Emergency Response Training Program, referred to as HAMMER, has been established at Hanford. This program will provide hands-on, performance-based training in all aspects of hazardous material safety. While the new 82-acre training center is being constructed, the program is offering a limited number of courses. The HAMMER program is a new, first-of-a-kind concept that shows exceptional promise and is considered a commendable practice. In addition to training Hanford HAZMAT emergency personnel, HAMMER will serve as a national resource to support the HAZMAT needs of organized labor; State, Tribal, and local Governments; and other Federal agencies.

Emergency supplies and equipment are described in site- and facility-specific emergency plans and procedures, including those for dedicated facilities such as the Hanford Emergency Operations Plant, multiple-use facilities such as the emergency operations room at the Plutonium Finishing Plant, and mobile vehicles such as the HAZMAT van owned by the Hanford Fire Department. Emergency equipment and supplies maintained by Hanford contractors include communications equipment, chemical treatment and containment kits, personnel protective equipment, facility material inventories, maps, and chemical exposure dose assessment computer programs. All emergency-related equipment and supplies are included in contractor-administered inventory and maintenance programs.

Until about 4 years ago, the focus of emergency management activities was on potential radiological accidents. As facilities shut down and missions shift toward D&D, there has been an increased awareness of the need to pay more attention to potential chemical accidents. This awareness has been heightened by the development of comprehensive worker right-to-know programs required by OSHA.

Most Hanford personnel interviewed during this review were generally aware that a fundamental shift in mindset is required to prepare fully for chemical emergencies—a shift from focusing on low-probability, high-consequence radiological accidents toward emphasis on higher probability, lower consequence accidents. Site personnel have been actively reviewing the Hanford Emergency Management Program in this light, and numerous efforts have been under way to change the program accordingly, including an expansion of the section addressing chemicals in the 5-year planning document titled "Emergency Readiness Assurance Plan."

A process to monitor changes at a facility is important for maintaining reliable chemical emergency plans and is required by 29 CFR 1910.120. PNL's chemical inventory data base is programmed to notify the PNL Emergency Coordinator when chemical inventories reach 90 percent of the permissible threshold quantity. Facility conditions can then be closely monitored for potential impacts on emergency plans. This approach is considered a commendable practice.

In summary, Hanford personnel have identified a number of improvements in the area of chemical emergency management that should enhance the maturity of the site's overall emergency management program. However, all personnel expressed confidence (1) that a firm foundation for such a program is already in place and (2) that a chemical emergency management program consistent with the hazards associated with Hanford's transition to D&D will continue to evolve.

3.0 CATEGORIZATION AND PRIORITIZATION OF VULNERABILITIES

3.1 Criteria

A vulnerability is defined as a weakness or potential weakness involving hazardous chemicals that could result in a threat to the environment, the public, or worker safety and health. Vulnerabilities can be characterized by physical or programmatic conditions associated with uncertainties, acknowledged deficiencies, and/or unacknowledged deficiencies in the area of chemical safety. Conditions required to create the vulnerability should either currently exist or be reasonably expected to exist in the future, based on degradation of systems and chemicals or through expected actions (i.e., **D&D** of facility),

A vulnerability will be determined to exist if current or expected future conditions or weaknesses could result in either of the following:

- The death of or serious physical harm[2] to a worker or a member of the public or the continuous exposure of a worker or member of the public to levels of hazardous chemicals above hazardous limits; or

- Environmental impacts resulting from the release of hazardous chemicals above established limits.

The prioritization of the chemical safety vulnerabilities is based on the professional judgment of team members concerning the immediacy of the potential consequences posed by each vulnerability and on the potential severity of those consequences. The first step in the prioritization process is to group vulnerabilities according to the timeframe in which they are expected to produce consequences. The following categories have been established for the timeframe within which consequences are expected to occur:

- <u>Immediate</u> — Any chemical safety vulnerability that could result in immediate consequences.

- <u>Short-Term</u> — Any chemical safety vulnerability at a facility in which there is a significant chance of a consequence occurring within a 3-year timeframe as a result of chemical degradation, change in mission for the facility, degradation of the containment systems, change in personnel at the facility, or other factors affecting the facility.

- <u>Medium-Term</u> — Any chemical safety vulnerability at a facility in which there is a significant chance of a consequence occurring within a 3–1 O year timeframe as a result of chemical degradation, change in mission for the facility, degradation of the containment systems, change in personnel at the facility, or other factors affecting the facility.

- <u>Long-Terrn</u> — Any chemical safety vulnerability at a facility in which there is a significant chance of a consequence occurring within a timeframe of more than 10 years as a result

[2] Serious physical harm is defined as impairment of the body, leaving part of the body functionally **useless or substantially reducing efficiency on or off the job.**

of chemical degradation, change in mission for the facility, degradation of the containment systems, change in personnel at the facility, or other factors affecting the facility.

Vulnerabilities within each category should be further prioritized to specify “high,” “medium,” or “low” priority based on the severity of the potential consequences. Examples of the second level of prioritization include the following:

- “ Prioritize potential harm to workers or the public according to the possible level of injury and/or health effects, ranging from transient reversible illness or injury to death.

- Prioritize environmental impacts based **on the level of irreversible damage and/or restoration costs.**

3.2 Chemical Safety Vulnerabilities at the Hanford Site

The chemical safety vulnerabilities summarized in this section were derived from specific observations made during the field verification process. Three vulnerabilities were identified at Hanford. They are prioritized in accordance with guidance provided in Section 3.1, which was derived from Attachment 7 of the “Project Plan for the Chemical Safety Vulnerability Review,” dated March 14, 1994. (Completed vulnerability forms are provided in Attachment 2 of this appendix.)

CSVR-RL-HAN-O1: Large quantities of surplus hazardous chemicals are being stored for prolonged periods in production facilities that are being transitioned to deactivated status.

Large quantities of nitric acid, aluminum nitrate, carbon tetrachloride, and tributylphosphate solvent are being stored at the PUREX Plant and at the Plutonium Finishing Plant in outside tanks or drums. Prolonged storage of hazardous chemicals in shutdown or deactivated facilities may lead to personnel hazards or environmental releases caused by spills, evaporation, leakage from corroded tanks or drums, decomposition of chemicals, or lack of adequate administrative controls. These conditions and circumstances represent a low-priority **vulnerability with a potential for short- to medium-term consequences.**

CSVR-RL-HAN-02: Weaknesses exist in some aspects of the hazard analysis program at Hanford.

Weaknesses exist in some aspects of the program and systems for performing various hazard analyses at the Hanford Site. The field verification team noted that the graded approach used to differentiate low-hazard work plans and packages from high-hazard plans and packages needs improvement. Differing hazard recognition and control systems implemented by multiple contractors, along with inconsistently performed facility hazard analyses, further contribute to an increased potential for personnel exposure to workplace hazards. These conditions and circumstances represent a medium-priority vulnerability with a potential for immediate consequences.

CSVR-RL-HAN-03: A loss of corporate knowledge may adversely affect cleanup activities at the Hanford Site.

The loss of corporate knowledge may result in chemical safety vulnerabilities, particularly when systems or components are operated, breached, or disassembled. The loss of corporate knowledge is a result of personnel turnover, inconsistent configuration management, failure to capture and retain characterization data, and reductions in the scope of the training program. These conditions and circumstances increase the possibility for accidents or releases involving hazardous chemicals and represent a low- to medium-priority vulnerability with a potential for immediate to short-term consequences. By the nature of this vulnerability, the severity of the consequences can be expected to increase with time.

Attachment 1

TEAM COMPOSITION

Area of Responsibility	Name/Organization
Team Leader	Bal M. Mahajan Office of Safety and Quality Assurance U.S. Department of Energy
Management/Operations	Bernard R. Kokenge BRK Associates, Inc.
Management/Training	Thomas L. Van Witbeck TOMA Enterprises
Chemical Process Safety	Harold J. Groh HJG, Inc.
Industrial Hygiene	James L. Woodring Argonne National Laboratory
Environmental Protection	Richard R, Lunt Arthur D. Little, Inc.
Maintenance	David M. Johnson Program Management, Inc.
Emergency Management	W. Earl Carries Office of Nuclear Safety U.S. Department of Energy
Site Liaisons	Doug S, Shoop Westinghouse Hanford Company
	David T. Evans Richland Operations Office U.S. Department of Energy
EH Site Representative	Robed C. Cullison Office of Safety and Quality Assurance U.S. Department of Energy
Coordinators	Nancy L. Sanderson EG&G Rocky Flats, Inc.
	Julie A. Sellars EG&G Idaho, Inc.
Technical Editor	Darla Treat Courtney Environmental Management Associates

ATTACHMENT 2

CHEMICAL SAFETY VULNERABILITY REVIEW
VULNERABILITY FORM **DATE: May 7, 1994**

'Site~Facility: **Hanford/PUREX and Plutonium Finishing Plant**

Vulnerability Number: CSVR-RL-HAN-01

Functional Area(s): **Identification of Chemical Holdings, Operational Control and Management .Systems**

1. **Brief Description of Vulnerability.**

   Large quantities of surplus hazardous chemicals are being stored for prolonged periods in production facilities that are being transitioned to deactivated status.

2. **Summary of Vulnerability.**

   Prolonged storage of hazardous chemicals in shutdown or deactivated facilities may lead to personnel hazards or environmental releases caused by spills, evaporation, leakage from corroded tanks or drums, decomposition of chemicals, or lack of adequate administrative controls.

3: **Basis.**

a. Requirements:

- **WHC Operating Procedure PO-020-290 describes spill response and cleanup of hazardous materials.**
- **WHC Operating Procedure PO-040-305 describes routine surveillance requirements for storage tanks.**
- **WHC-CM-5-8, 3.12, "Carcinogen Control Program," describes the carcinogen control program for the Plutonium Finishing Plant (PFP).**
- **WHC-CM-5-8, 7.1, "Hazardous Material Management Plan," describes management requirements for storage areas, labeling, compatibility, training, and emergency response.**
- **WHC-CM-7-5, "Environmental Compliance," describes requirements for hazardous materials storage tanks, such as labeling and spill plans.**
- **29 CFR 1910.1200, "Hazard Communication Standards," specifies requirements for training, communications, and material safety data sheets.**

b. Chemicals Involved:

- **Forty-eight 55-gallon drums (2,640 gallons total) containing unused carbon tetrachloride are stored outside PFP.**
- **About 3,000 gallons of 12M nitric acid are stored in one stainless steel tank located outside PFP.**
- **About 8,000 gallons of 3M aluminum nitrate solution are stored in 2 stainless-steel tanks at PFP (one tank inside the facility, one tank outside).**
- **About 190,000 gallons of nitric acid, ranging from 7M to 11 M, were recovered at the UO_a Plant, returned to the PUREX Plant, and stored in seven stainless-steel tanks (five tanks outside the plant and two inside).**
- **About 21,000 gallons of slightly contaminated tributylphosphate (23 percent) in normal paraffin hydrocarbon solvent were recovered from the PUREX Plant and are stored in one stainless-steel tank outside the plant.**

Site/Facility: Hanford/PUREX and Plutonium Finishing Plant

Vulnerability Number: CSVR-RL-HAN-O1

Functional Area(s): Identification of Chemical Holdings, Operational Control and Management Systems

4. Supporting Observations. (Continued)

- The carbon tetrachloride (CCI,) stored outside the PFP was purchased for use in the plant process but may no longer be needed because of the conversion of the plant to inactive status. CCl_d is a suspected human carcinogen and is stored in 48 55-gallon plastic-lined, carbon steel drums, which are approved for this use. The drums are stored outdoors on poly-spill pallets beneath a tent for protection from the weather. Several drums have leaked in the past because of corrosion, resulting in release of CCl_d to the environment and worker exposure. (No injuries occurred). The drums that leaked were stored without protection from the weather and without leak-containment pallets. The only routine leak detection of these drums is performed by visual inspection. Because of the placement on the pallets, the interior drums cannot be inspected. The area is posted to warn workers of the hazard, and the drums are properly labeled. Preparations are being made to sell the CCl_d to a vendor, but this option is being reviewed because of the need to prepare an EIS to examine the future use of the PFP. There is some concern that sale of the CCI_A might be perceived to limit EIS options because CCI_Q is the solvent used for a plutonium recovery process. WHC is evaluating whether these drums should be moved to indoor storage in the event that storage over an extended period of time is required.

  The nitric acid and aluminum nitrate solutions stored at PFP are not radioactively contaminated, and quantities not used for the cleanout of the plant will probably be sold to vendors. The stainless-steel tanks containing the nitric acid and aluminum nitrate solutions are about 40 years old and are not routinely inspected by nondestructive examination (NDE) methods for deterioration of wall thickness. (NDE was conducted on the tank walls in 1987; no inadequacies were identified.) The tanks are installed in diked areas for spill containment.

b The PUREX Plant was originally shut down in December 1988 because of an operational safety requirement (OSR) violation. Subsequent to the OSR violation, WHC management instituted corrective actions in response to DOE restart requirements. These actions were completed in March 1990, at which time the PUREX Plant began transition to a standby status. PUREX remained in transition to standby status under DOE direction until December 1992, at which time an order for permanent shutdown was issued. In October 1993, DOE made the decision to deactivate the PUREX Plant, and deactivation activities are now under way. More than 5 years have elapsed since the original shutdown, Since 1991, considerable progress has been made in removing excess chemicals. In 1991 alone, about 2 million pounds of process chemicals were removed from the plant.

Site/Facility: Hanford/PUREX and Plutonium Finishing Plant

Vulnerability Number: CSVR-RL-HAN-01

Functional Area(s): Identification of Chemical Holdings, Operational Control and Management Systems

4. Supporting Observations. (Continued)

Although an overall project plan has been proposed for the deactivation of the plant, and even though deactivation is under way, specific endpoint criteria are not expected to be in place until the end of 1994. The removal of all chemical residues from the PUREX Plant is not expected until the end of 1996.

– A total of 190,000 gallons of nitric acid was recovered from the $U0_3$ Plant and transferred to the PUREX Plant. The nitric acid is slightly contaminated with radioactivity; therefore, it cannot be sold for uncontrolled use. The current plan is to transfer the material to the British Government for use in its reprocessing plants. This plan may be pursued in the near term.

– A total of 21,000 gallons of tributylphosphate (TBP) solvent was recovered from the PUREX process. The TBP is slightly contaminated with radioactivity. A plan to ship this material to the INEL chemical processing plant, where it would be burned in the waste calciner, has been stopped for regulatory reasons, Idaho will not accept the waste because it is a regulated as a dangerous waste in Washington State (although it is not a regulated waste in Idaho). The material cannot be shipped to the new incinerator under construction at SRS because South Carolina has permitted the facility only for SRS-generated wastes. Other options are being examined, including commercial incinerators and a purchased steam reformer that would destrov the solvent. These options are currently being assessed in an engineering study. The solvent will probably be stored for several years before the issue can be resolved. There is some risk of leakage from the tank, which creates the potential for worker exposure and a small risk of solvent fires. The tank is in a diked area, is monitored, and has fire protection.

CHEMICAL SAFETY VULNERABILITY REVIEW
VULNERABILITY FORM

DATE: May 7,1994

Site/Facility: Hanford

Vulnerability Number: CSVR-RL-HAN-02

Functional Area(s): Operational Control and Management Systems

1. Brief Description of Vulnerability.

Weaknesses exist in some aspects of the hazard analysis program at Hanford.

2. Summary of Vulnerability.

Weaknesses exist in the program and systems for performing various chemical hazard analyses at the Hanford Site. Because of the workload of industrial hygiene and safety personnel, job hazard analyses (JHAs) are not alwavs reviewed by WHC in a thorough and rigorous manner. The different hazard recognition and control systems implemented by the ‘multiple contractors, along with inconsistently performed facility hazard analyses, further contribute to an increased potential for personnel exposure to workplace hazards.

3. Basis.

a. Requirements:

- DOE 5480.10, paragraph 9, requires that the contractor (1) identify and evaluate chemical hazards in the workplace and (2) implement control measures to prevent or minimize exposure to these hazards.
- WHC-CM-4-3, “Pre-Job Safety Planning/Job Hazard Analysis,” dated April 30, 1993, provides the basis for performing a JHA.
- DOE 5481.1 B requires the preparation of safety analyses for all DOE facilities, except for those designated as “excluded.”
- PNL-MA-44, “Safety Analysis,” requires a safety analysis document (i.e., a “Hazard Management Plan,” or HMP) for all PNL nonnuclear, low-hazard facilities.

b. Chemicals Involved:

- This vulnerability relates to hazard analysis in general and, thus, to all chemicals posing a hazard in the workplace.
- The example cited at the WHC Chemical Engineering Laboratory (CEL) involved the following chemicals:

Chemical	Form	Quantity [Kg)
Tributylphosphate	liquid	28.7
Normal Paraffin Hydrocarbons	liquid	12,3

c. Relevant Self-Evaluation Data: The JHA program was not perceived as a potential vulnerability.

 DATE: May 7, 1994

Site/Facility: Hanford

Vulnerability Number: CSVR-RL-HAN-02

Functional Area(s): Operational Control and Management Systems

3. Basis. (Continued)

d. Contributing Causes: Programs for conducting chemical hazard analysis have not been properly or consistently implemented.

e. Potential Consequences: There is an increased potential for personnel exposures to workplace hazards when hazard analyses are not rigorously performed. These conditions and circumstances represent a medium-priority vulnerability with a potential for immediate consequences.

4. Supporting Observations.

- The application of rigorous job hazard analysis has become increasingly crucial at the Hanford Site. The shift from a position-based qualification and/or certification approach to a task-based training approach makes the job hazard analysis even more crucial to the training process. The loss of certified operators having extensive process and facility knowledge also forces greater reliance on JHAs to ensure the protection of workers, facilities, and the public.

- Training associated with the PUREX Facility Building Emergency Plan and Hazards Checklist (Course No, 03 E024) provides instructions on the use of a material safety data sheet, but it does not require that specific chemical hazards be discussed. Certification for PUREX deactivation operators does not address the chemical hazards of the waste streams transferred by the operators.

- The Plutonium Finishing Plant (PFP) Hazards Communication Program does not address specific chemical hazards in the workplace, although a revised program that addresses this matter is in the process of being approved. The field verification team noted that pre-job briefings conducted at PUREX and PFP address job-specific chemical hazards.

- A review of approved JHA work plans for the CEL indicated that these plans do not always receive a thorough and indepth review by industrial hygiene and/or industrial safety personnel when required. In many cases, sign-offs are obtained to take care of "paperwork" without conducting an indepth review of the proposed work.

- Discussions with CEL management indicated that industrial hygienists visit the CEL workplace on an infrequent basis, even though hazardous chemicals are routinely handled in the facility.

- Discussions with WHC industrial safety and/or industrial hygiene personnel indicated that they may review as many as 30 work plans or work packages per day. The workload does not permit sufficient time for thorough review, The situation is further exacerbated by a review system that permits low-hazard work packages to receive the same level of review as that for higher hazards,

- Technical safety support personnel at PUREX Plant are developing a JHA process for their work plans because, in their opinion, the current WHC JHA system does not provide a thorough or rigorous review of work plans.

'Site/Facility: Hanford

Vulnerability Number: CSVR-RL-HAN-02

Functional Area(s): Operational Control and Management Systems

4. Supporting Observations. (Continued)

- The WHC Safety Department has just completed a reorganization to resolve recognized weaknesses in the JHA review process, The intent of these organizational changes is to align resources on a project basis and to locate Safety Department personnel physically closer to the areas they support. Because WHC Safety Department management recognizes that these changes will not completely resolve weaknesses associated with the JHA process, additional corrective actions are currently being evaluated.

- Hanford Site is operated by multiple contractors, each with its own work control system. Thus, contractor hazard recognition and control systems may differ. Nonuniform application of work control requirements to protect the work force can lead to confusion, procedural noncompliance, or injury and is an issue at the Hanford Site, A near-miss event still under investigation supports this point. The event occurred on April 20, 1994, when ICF Kaiser Hanford Company personnel, relying on information from a subcontractor, were in the process of removing a blank on a 25-psi steam line without having the required double-valve isolation in place upstream. The work had not been approved by 222-S management.

- The PNL Life Sciences Laboratory 1, Building, is a large laboratory facility for chemical, biological, and environmental research. Many hazardous chemicals are present in the laboratory, usually in small amounts. The laboratory was designated as a nonnuclear, low-hazard facility. DOE 5481.1 B requires the preparation of safety analyses for all DOE facilities (other than those designated as excluded). Consistent with this Order, PNL Manual PNL-MA-44, “Safety Analysis,” requires a safety analysis document (i.e., an HMP) for all PNL nonnuclear, low-hazard facilities. No HMP exists for the 331 Building, and there are no plans to prepare one. RL and PNL management both explained that higher priority is being given to safety analysis activities for nuclear facilities and that numerous other analyses-such as JHAs, workplace exposure assessments, test plans, engineering analyses, and fire safety reviews-give adequate assurance of safety for the laboratory and for protection of workers.

- Lack of DOE guidance for conducting rigorous safety analyses of chemical process hazards was acknowledged to be an ongoing problem by RL and contractor management. It was noted that guidance may be forthcoming in two proposed DOE technical standards, “Analysis of Chemical Process Hazards” and “Process Safety Management for Highly Hazardous Chemicals.” RL has recognized the need for a more systematic approach to identify, analyze, control, and communicate hazards and to define more clearly the requirements for when safety, process, and hazard analyses are needed. As a first step, RL has issued a draft standard, (RL-STD-01 -94, “Hazard Analysis and Communication”) for comment by Hanford contractors. Implementation of this standard is expected to take place in about 6 months.

CHEMICAL SAFETY VULNERABILITY REVIEW
VULNERABILITY FORM

DATE: May 7, 1994

Site/Facility: Hanford/PUREX and Plutonium Finishing Plant

Vulnerability Number: CSVR-RL-HAN-03

Functional Area(s): Operational Control and Management Systems, Human Resource Programs

1. Brief Description of Vulnerability.

A loss of corporate knowledge may adversely affect cleanup activities at the Hanford Site.

2. Summary of Vulnerability.

The loss of corporate knowledge may result in chemical safety vulnerabilities, particularly when systems or components are operated, breached, or disassembled, The loss of corporate knowledge is a result of personnel turnover, inconsistent configuration management, failure to capture and retain characterization data, and reductions in the scope of the training program.

3. Basis.

a. Requirements: The safety and health of workers and the public must be preserved for all activities conducted for or by the Department. The requirements of DOE Orders affect the loss of corporate knowledge by regulating the activities that have contributed to such losses. In general, the requirements of the Orders are addressed by the management systems that currently exist at Hanford; however, many of the deficiencies related to the loss of corporate knowledge predate the Orders.

The following Orders apply to the Supporting Observations (Section 4 of this form): DOE 1324.2A, "Records Disposition for DOE Facilities," dated July 9, 1990; DOE 5480.20, "Personnel Selection, Qualification, Training, and Staffing Requirements at DOE Reactor and Non-Reactor Nuclear Facilities," July 20, 1991; DOE 6430.1 A, "General Design Criteria," April 6, 1989; 29 CFR 1910.120, "Hazardous Waste Operations and Emergency Response;" and 25 CFR 1910.1200, "Hazard Communication Standards."

b. Chemicals Involved:

- Plutonium and plutonium compounds
- Uranium and uranium compounds
- About 176 pounds of sodium hydroxide
- Forty-eight 55-gallon drums (2,640 gallons total) containing unused carbon tetrachloride are stored outside the Plutonium Finishing Plant (PFP).
- About 3,000 gallons of 12M nitric acid are stored in one stainless-steel tank outside the Plutonium Finishing Plant.
- About 8,000 gallons of 3M aluminum nitrate solution are stored in two stainless-steel tanks at PFP (one tank inside the facility, one tank outside).
- About 190,000 gallons of nitric acid, ranging from about 7M to 11 M, were recovered at the UO3 Plant, returned to the PUREX Plant, and are stored in seven stainless-steel tanks (five tanks outside the plant and two inside).

Site/Facility: Hanford/PUREX and Plutonium Finishing Plant

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3, Basis. (Continued)

. About 21,000 gallons of slightly contaminated tributylphosphate (23 percent) in normal paraffin hydrocarbon solvent were recovered from the PUREX Plant and are stored in one stainless-steel tank outside the plant.

c. Relevant Self-Evaluation Data: Issue not addressed.

d. Contributing Causes:

- PUREX Plant is an old facility that has had an incomplete configuration management program for much of its lifetime; therefore, complete and accurate records of all systems and processes are not available.
- Many certified operators and managers knowledgeable about the operation of the PUREX Plant and the PFP have transferred to other facilities or have left the Hanford Site.
- WHC management is aware of the continual loss of experienced personnel at the PUREX Plant. However, there is no plan in place to minimize these losses.
- The protracted decision-making process for determining the ultimate disposition of Hanford facilities has created an atmosphere of uncertainty about the future, which in turn has resulted in the loss of experienced personnel.

e. Potential Consequences: The increased potential for accidents or releases involving hazardous chemicals caused by these conditions represents a low- to medium-priority vulnerability with a potential for immediate to short-term consequences. By the nature of this vulnerability, the severity of the consequences can be expected to increase with time.

4. Supporting Observations.

- As a result of the protracted shutdown of both PFP and PUREX, many operators assigned to these facilities have limited knowledge and experience in the operation of process equipment and systems. The PUREX Plant has been shut down since December 1988. Since that time, particularly over the past 3 years, there has been a steady decline in overall staffing levels at PUREX Plant. For example, about 122 nuclear and/or power operators were involved in operations 3 years ago; today, only 55 are involved.

- The decision-making process concerning facility disposition has become protracted because of a number of factors, as discussed in the supporting observations cited in Vulnerability CSVR-RL-HAN-O1. The protracted decision-making process has contributed to uncertainty about future job opportunities. Fearing the loss of jobs or the lack of professionally rewarding opportunities, many experienced personnel are leaving their current positions to pursue other opportunities. For example, during the course of the Chemical Safety Vulnerability Review, an engineer with 14 years of PUREX experience left the facility for a position in high-level waste technology.

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4. Supporting Observations. (Continued)

- Bechtel's designation as the Environmental Restoration Contractor (ERC) has increased the level of uncertainty for many Hanford personnel.

- PUREX currently has five classifications for which certification is compensated: Dispatcher, Solid Waste Handler, Deactivation Operations, N Cell, and Surveillance (OSR). Compensation is per certification and is cumulative up to six certifications. As the need for personnel in each classification is reduced, or the number of classifications is reduced, senior personnel with extensive knowledge of the facility may transfer to facilities with more positions per classification or more classifications.

- Training at PUREX is shifting from a position-based qualification and/or certification approach to a discrete task-based approach. In a task-based approach, training is limited to that which is necessary to perform the work associated with a given task. Courses addressing a facility and/or processes that are characteristic of a position-based training program will be eliminated. As a result, new staff members will have less knowledge of the facility.

- As process and technical training requirements are reduced, the need for instructors having extensive knowledge in these areas will also be reduced.

- The move to a deactivated status has resulted in scheduled budget reductions for training, which in turn will force reductions both in staff and in the scope of the training program.

Attachment 3

SELECTED ACRONYMS

CFR	Code of Federal Regulations
D&D	Decontamination and Decommissioning
DOE	U.S. Department of Energy
EIS	Environmental Impact Statement
EH	DOE Office of Environment, Safety and Health
HEHF	Hanford Environmental Health Foundation
ICF KH	ICF Kaiser Hanford Company
OSHA	Occupational Safety and Health Administration
PNL	Pacific Northwest Laboratory
RCRA	Resource Conservation and Recovery Act
RL	Richland Operations Office
SARA	Superfund Amendments and Reauthorization Act
WHC	Westinghouse Hanford Company